

Ten Years at the Calif. Energy Commission & White Roofs to Cool your Building, your City and (this is new !) Cool the World

Carnegie Endowment, Washington DC
Sept. 15, 2011

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California Energy Commission.

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510 495-2227

Presentation available at www.ArtRosenfeld.org

**Winners
Art
Rosenfeld
&
Philipp
Rutberg**



**President
Medvedev
presents award
to
Art Rosenfeld**

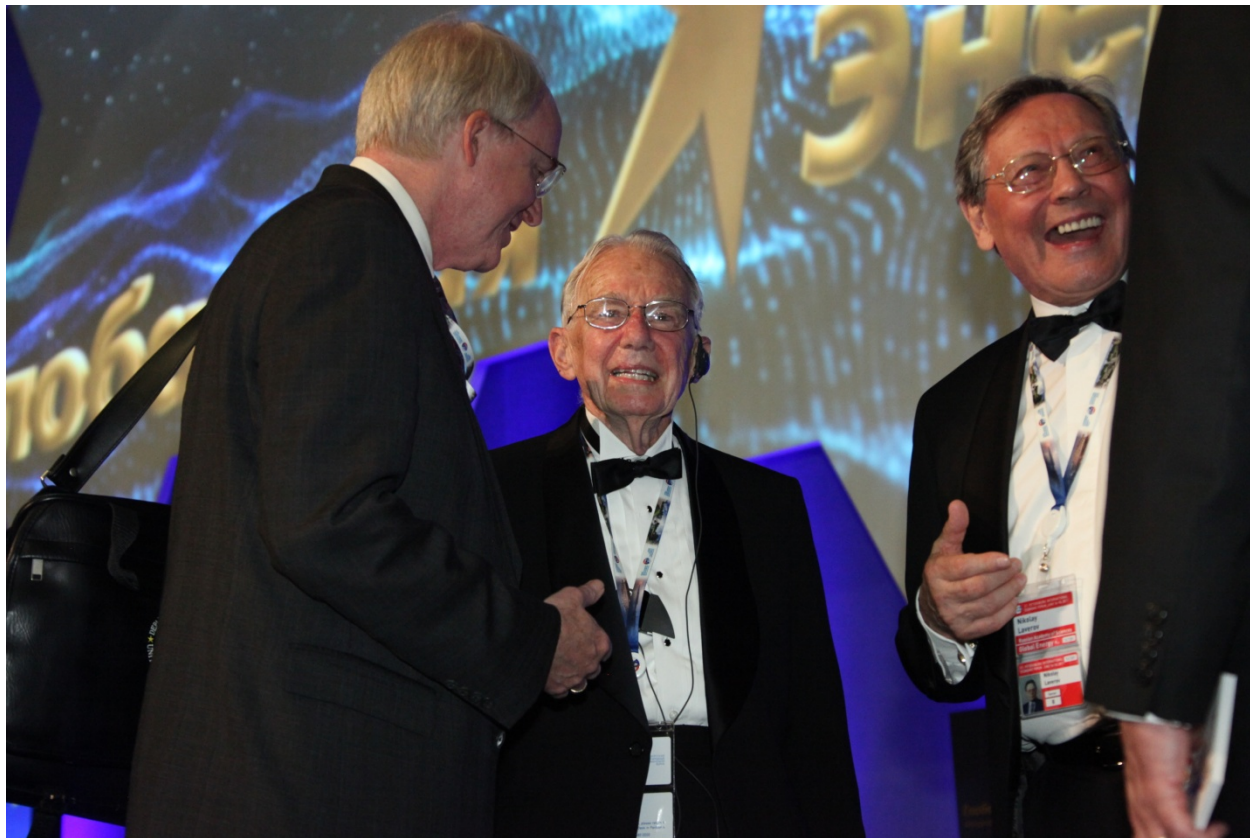


Following the Ceremony

John Beyrle, American Ambassador to Russia

Art Rosenfeld

Nikolay Laverov, Academician, Chairman, International Award Committee



Prize winners exchange toasts

Art Rosenfeld and Philipp Rutberg

with Global Energy Prize

Board of Trustees Chairman and former winner of GEP, Evgeni Velikov



Ten Years at the Calif. Energy Commission & White Roofs to Cool your Building, your City and (this is new !) Cool the World

St. Petersburg Polytechnical University
June 15, 2011

Arthur H. Rosenfeld, Former Commissioner
California Energy Commission.

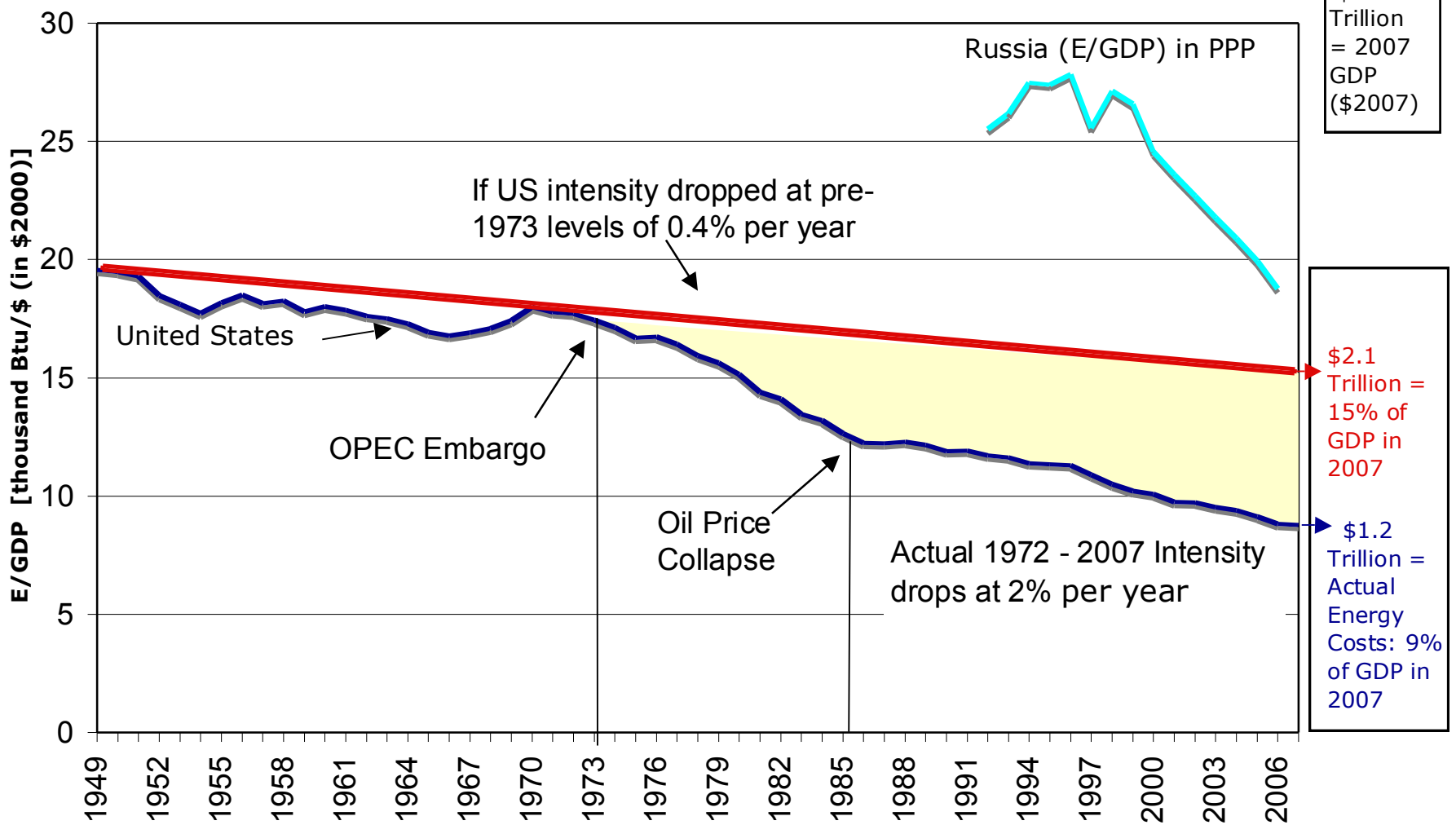
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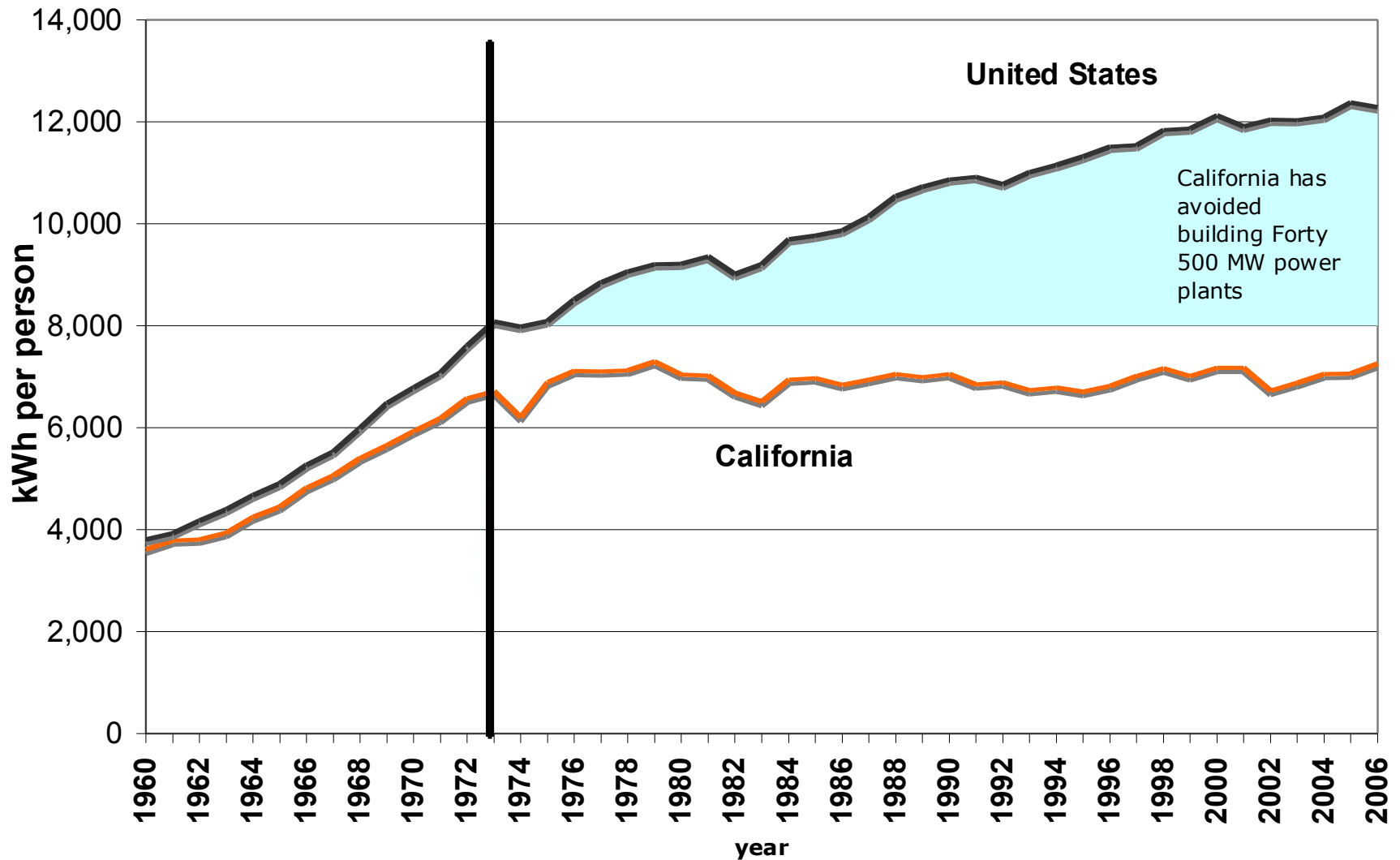
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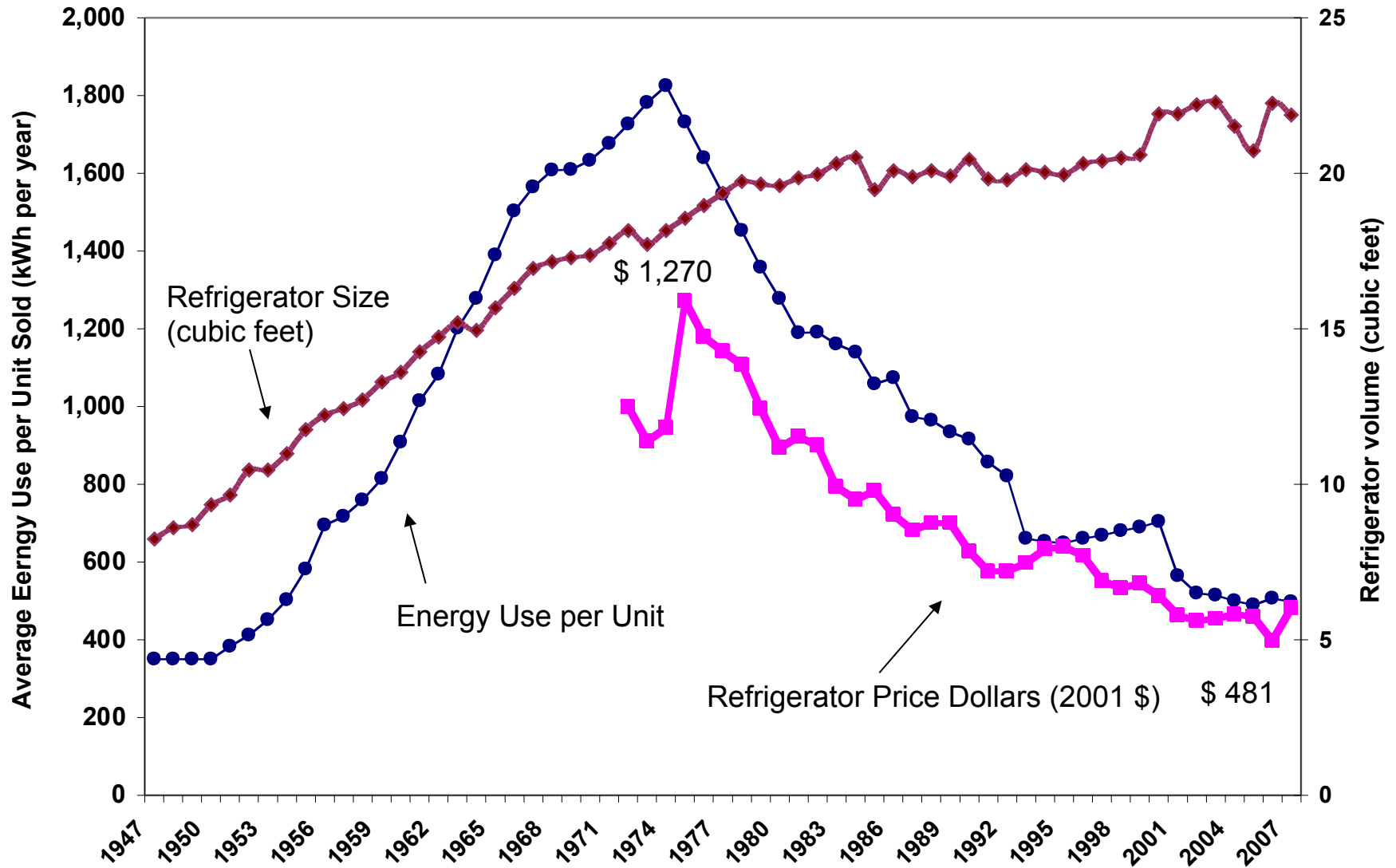
Energy Intensity (E/GDP)



Per Capita Electricity Consumption



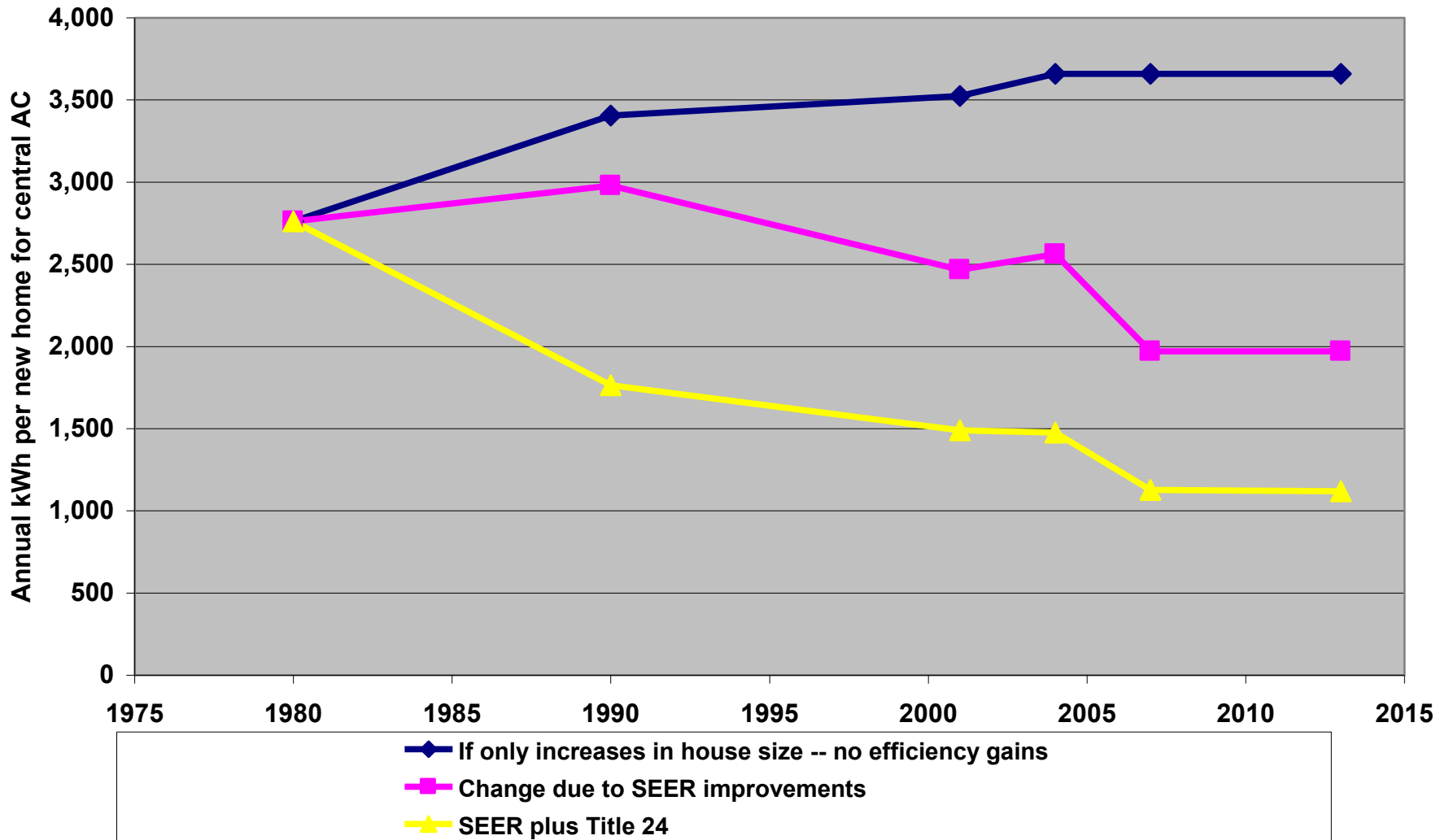
United States Refrigerator Use v. Time



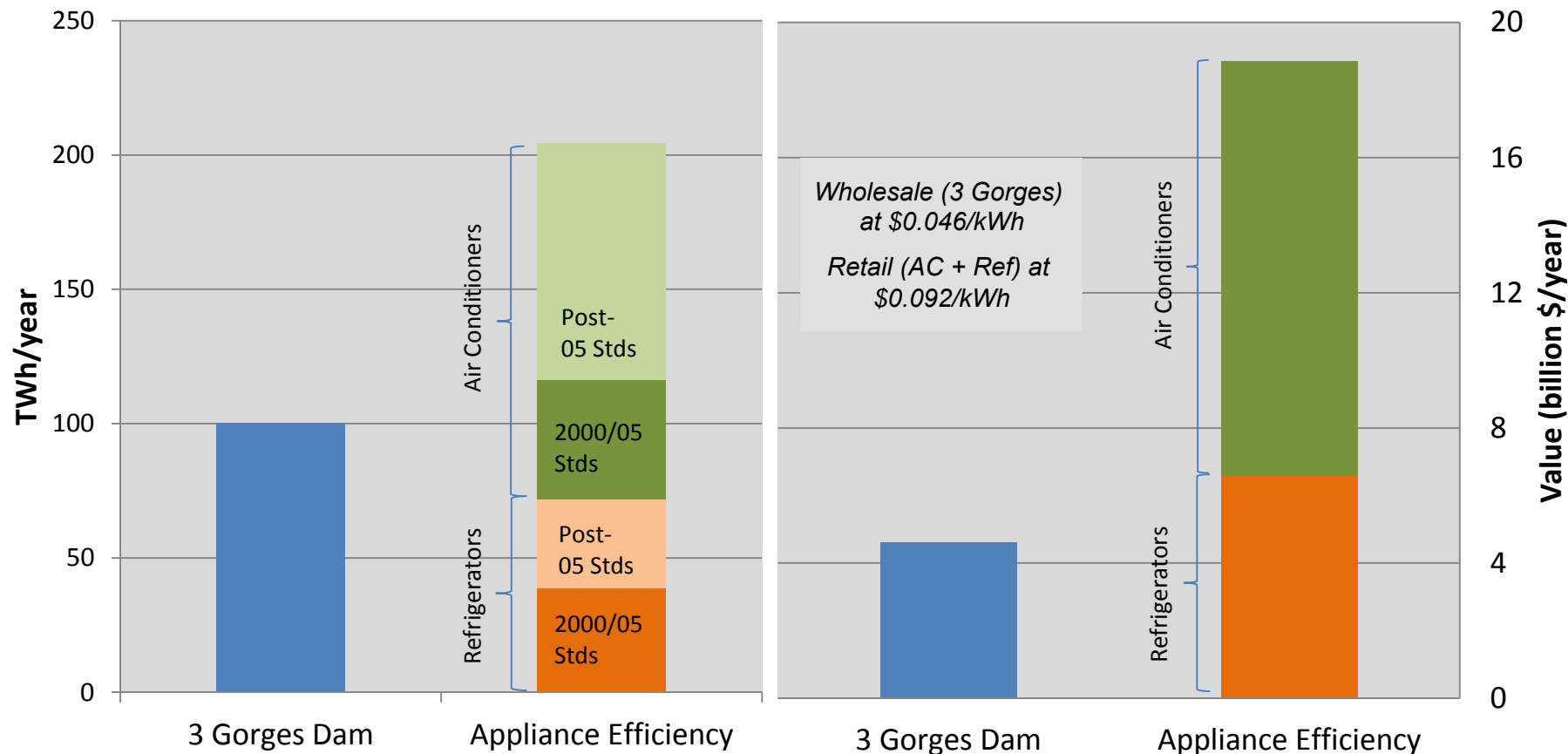
David Goldstein, NRDC and Pat McAuliffe, CEC

Air Conditioning Energy Use in Single Family Homes in PG&E

The effect of AC Standards (SEER) and Title 24 standards



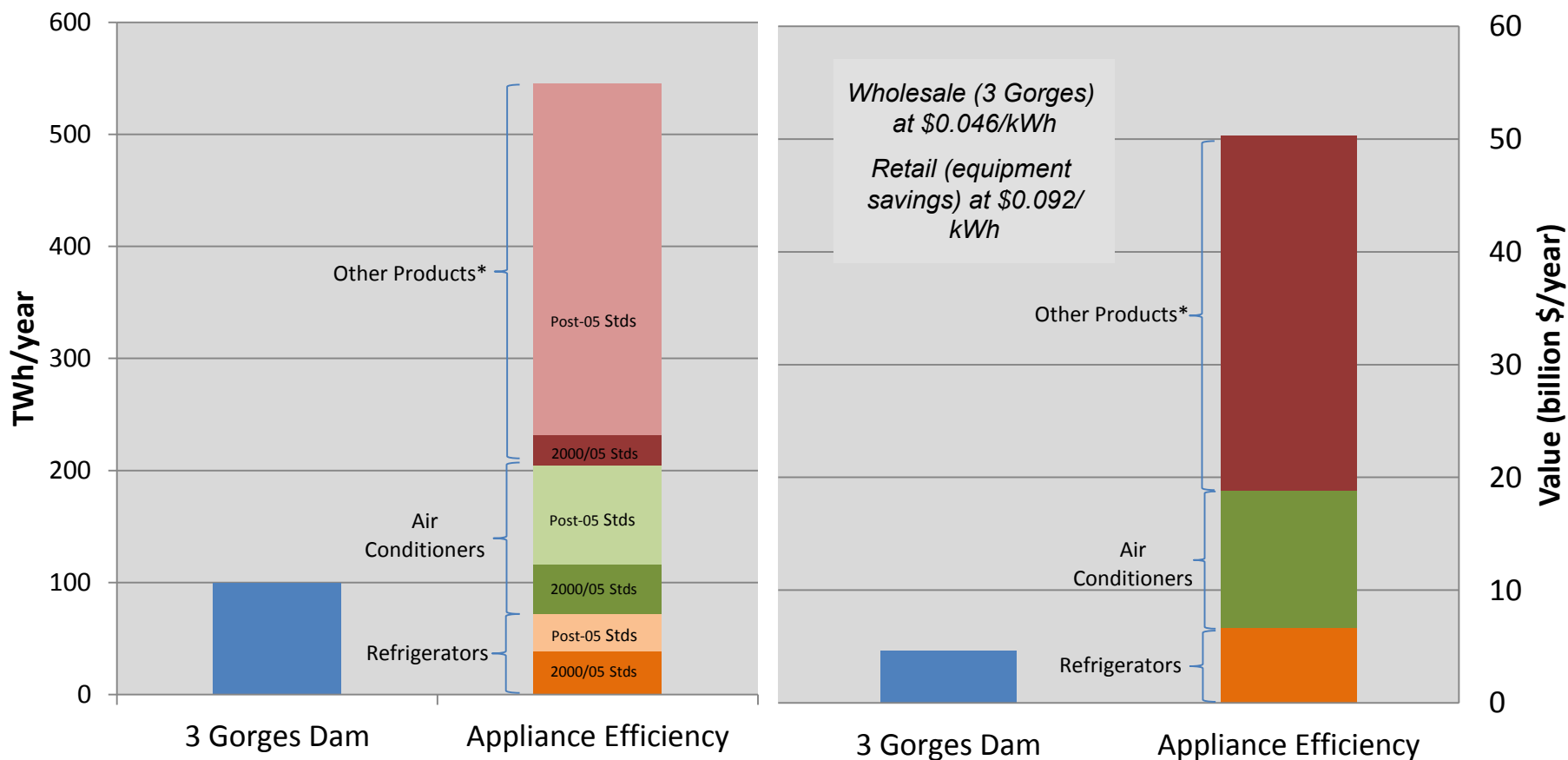
Annual generation from China's Three Gorges Dam compared to annual savings in 2020, from 20 years of sales of refrigerators and ACs with increasing energy efficiency



Appliance efficiency savings are calculated on the basis of annual savings in 2020. "Post-05" standards accounts for China's periodic standards revision schedule of 4 to 5 years.

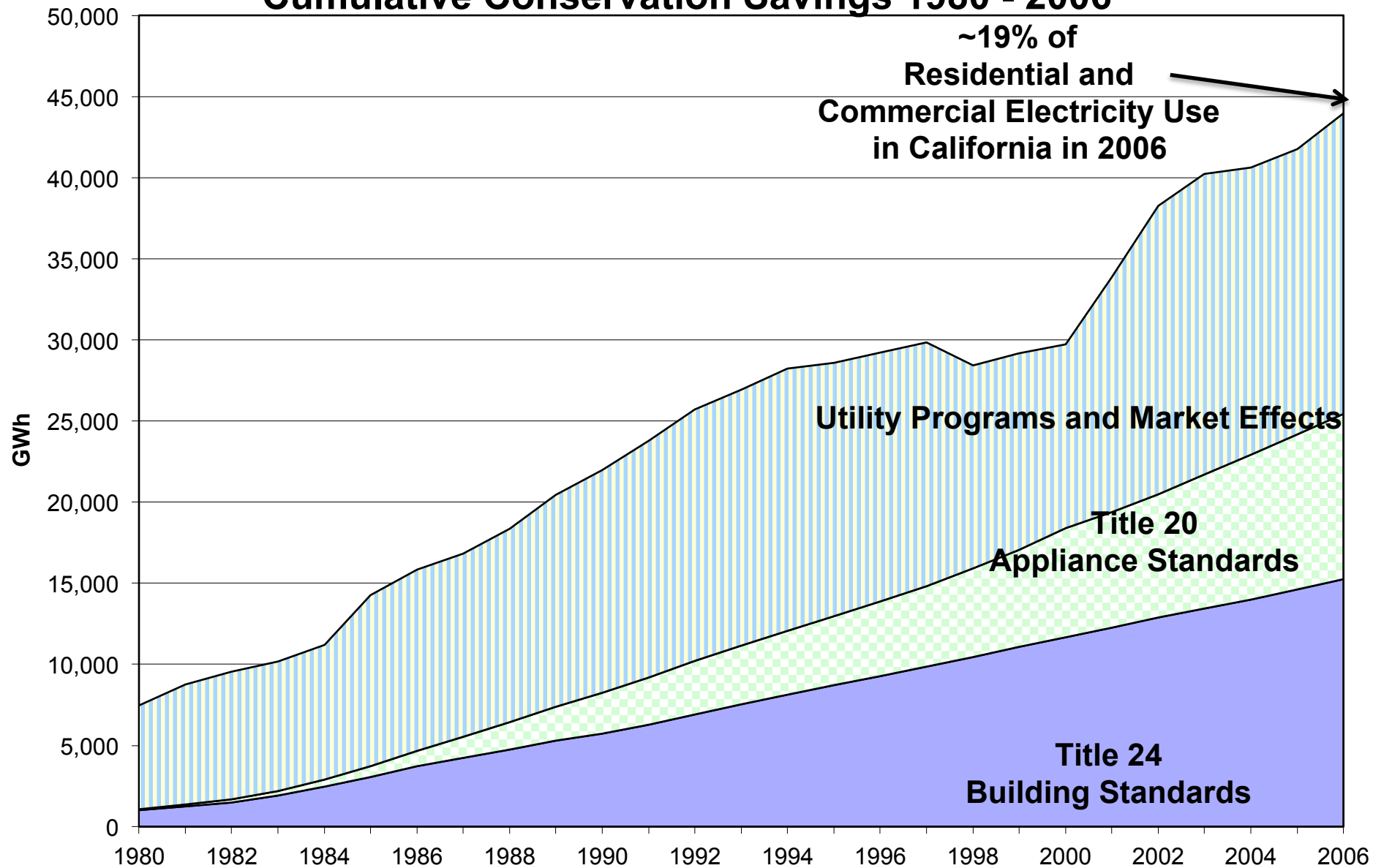
Source: LBNL China Energy End-Use Model, David Fridley and Nina Zheng, 2010

Annual generation from China's Three Gorges Dam compared to annual savings in 2020, from 20 years of sales of equipment subject to China's energy efficiency standards



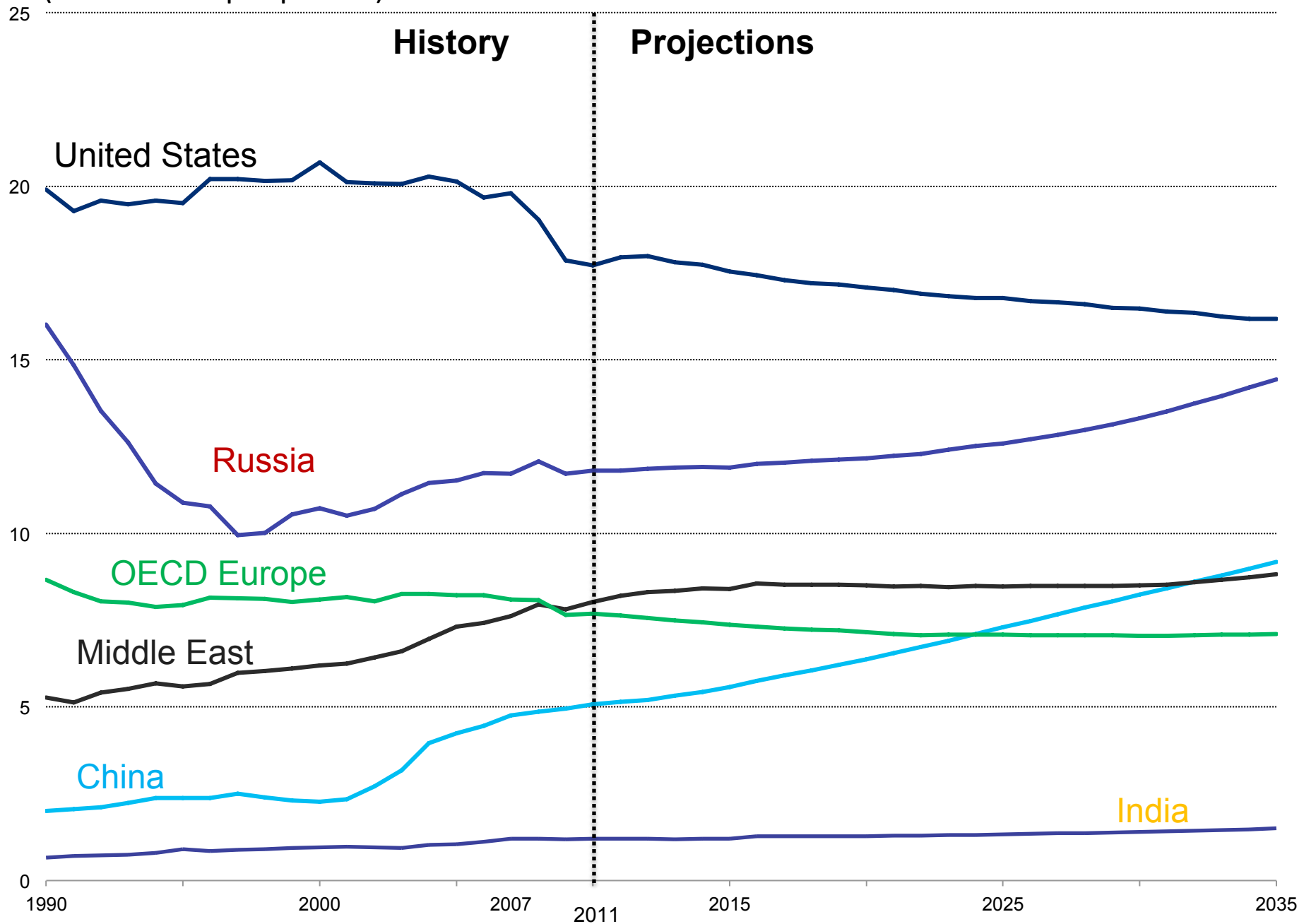
*Other products include: clothes washer, TV, fans, stand-by power, electric water heater, electric cooktop, fluorescent lamp ballasts, rice cooker, microwave ovens, laser printers, fax, copiers, computer monitors, HID lamps and ballasts, motors, air compressors, transformers, servers, computers, double-capped fluorescents, heat pump water heater, rangehoods, ventilating fans, external power supply, vending machines, LED lamps, grid lighting, commercial AC chillers, water-cooled chillers, unitary AC

Residential and Commercial Cumulative Conservation Savings 1980 - 2006



Source: Art Rosenfeld, California Energy Commission

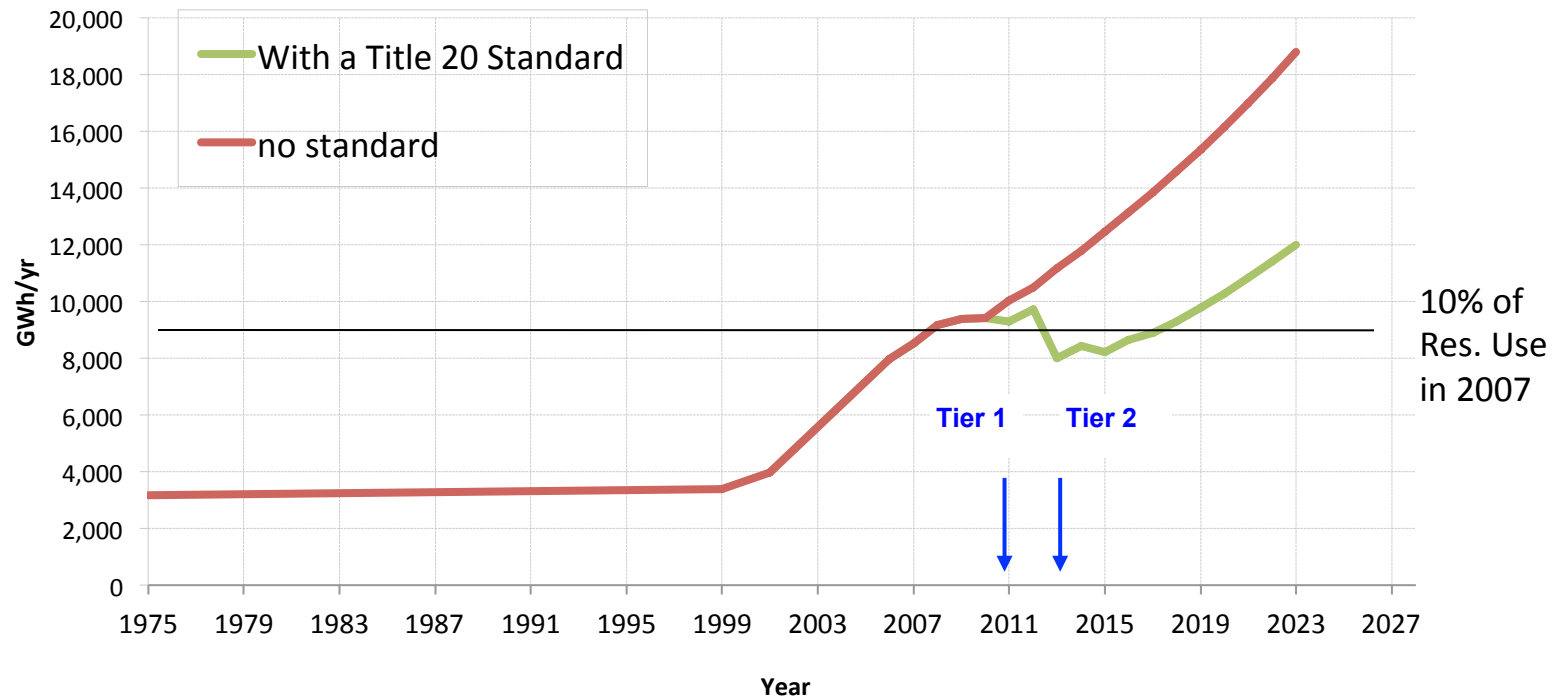
Figure 113. CO2 emissions per capita by selected country and region, 1990-2035
(metric tons per person)



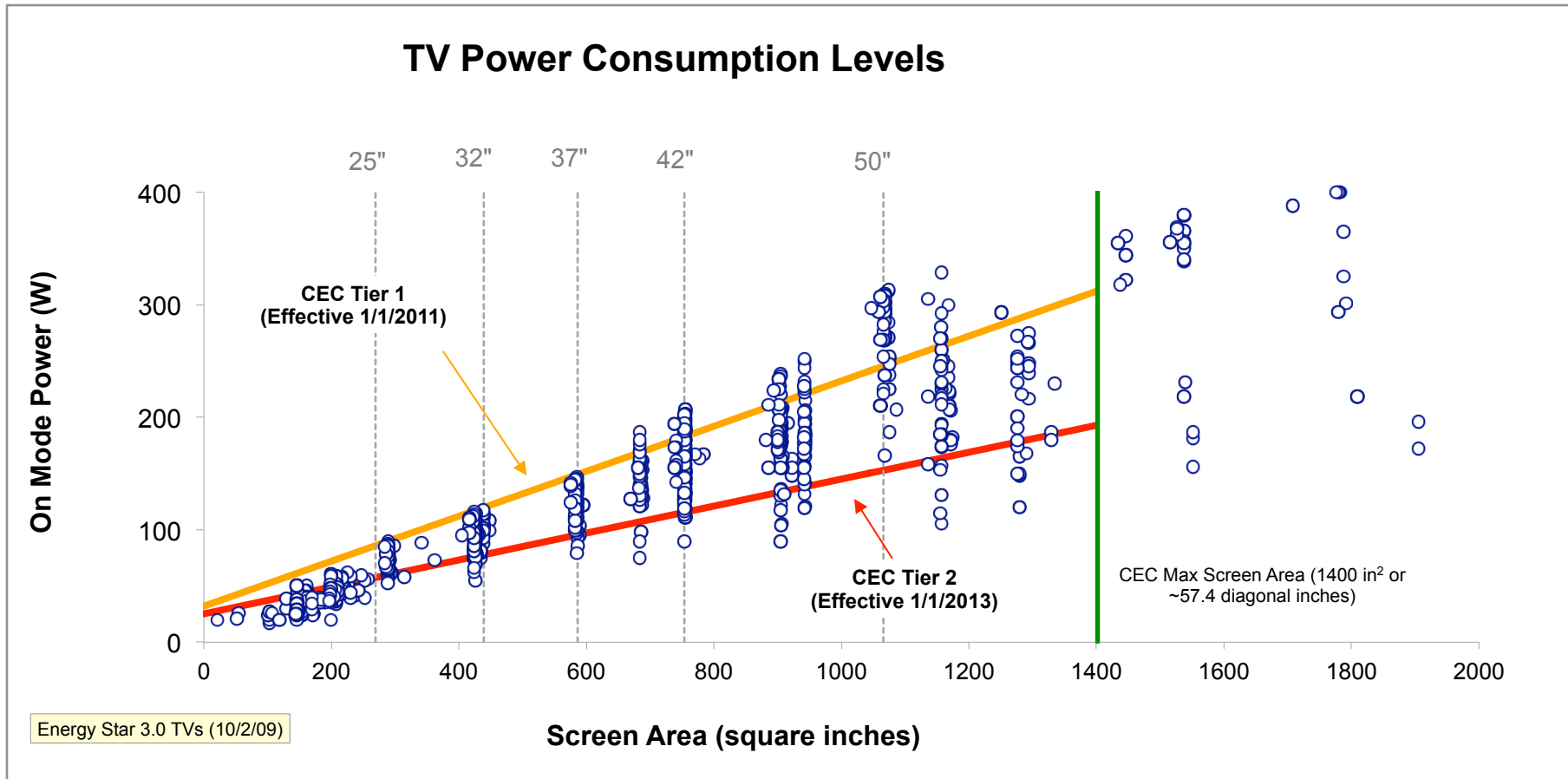
Televisions Represent Significant Energy Use

The residential energy consumption due to televisions rapidly increased from 3-4% in 1990s to 8-10% in 2008. Television energy will grow up to 18% by 2023 without regulations. The projected growth does not include the residential energy use by cable boxes, DVD players, internet boxes, Blue Ray, game consoles etc.

**California Energy Consumption from TVs
(Forecast with and without proposed standards)**



Technically Feasible Standards



Each point may represent several TV models

***Consumers can expect to save between \$ 50 - \$ 250 over the life of their TV**

***A 50 inch plasma can consume as little as 307 kWh/yr and as much as 903 kWh/yr**

General Purpose Lighting – Proposed Regulations (cont.)

Proposed Table K-8: Standards for State-regulated General Services Incandescent Lamps -Tier I

Rated Lumens Range	Maximum rated Wattage	Minimum Rated Life Time	Proposed California Effective Date
1490-2600 Lumens	100→72 Watts	1,000 hours	Jan, 1, 2011
1050-1489 Lumens	75→53 Watts	1,000 hours	Jan 1, 2012
750-1049 Lumens	60→43 Watts	1,000 hours	Jan 1, 2013
310-749 Lumens	40→29 Watts	1,000 hours	Jan 1, 2013

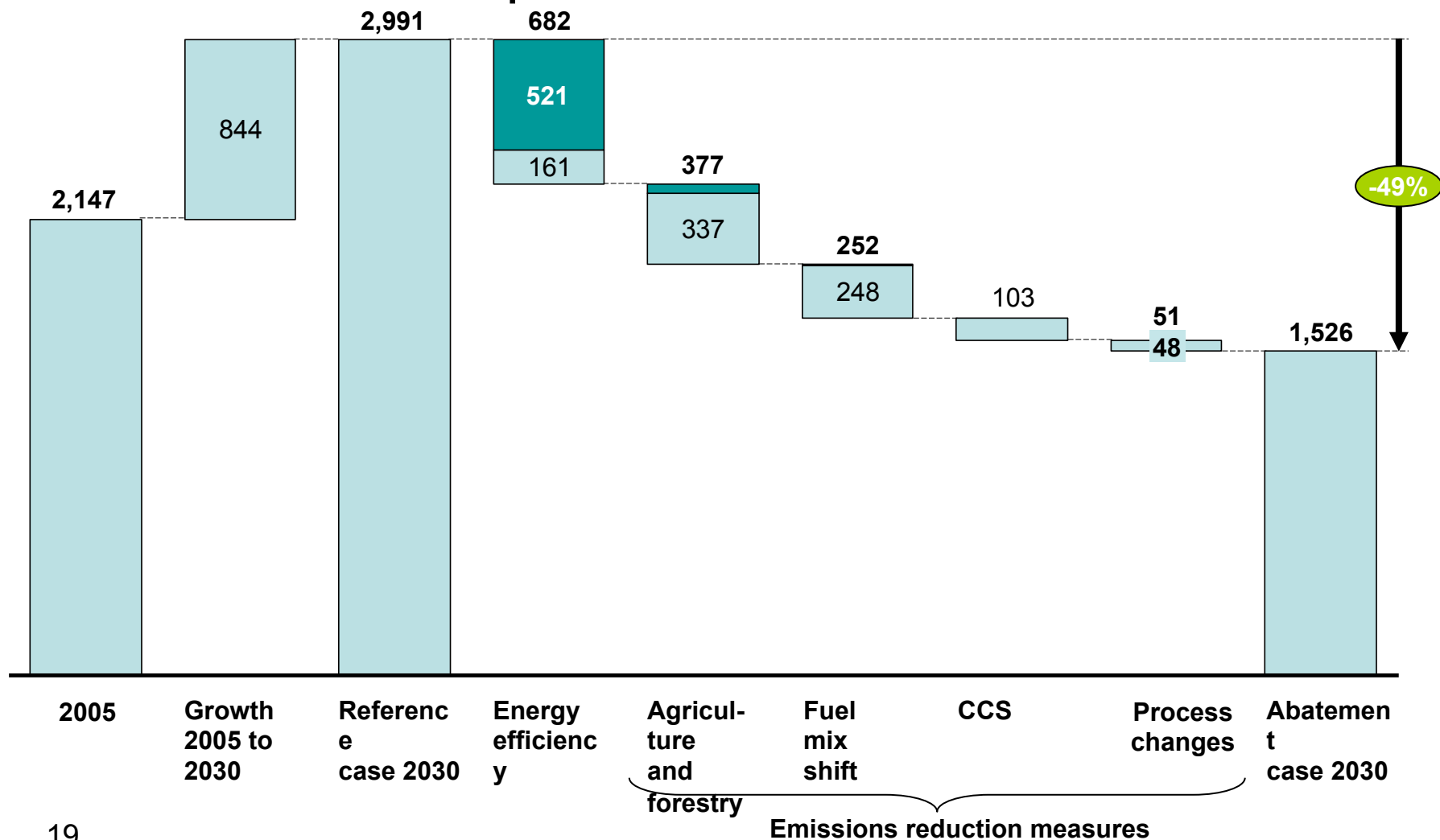
Proposed Table K-9: Standards for State-regulated General Services Lamps -Tier II

Lumens Range	Maximum Lamp Efficacy	Minimum Rated Life Time	Proposed California Effective Date
All	45 lumens per watt	1,000 hours	Jan, 1, 2018

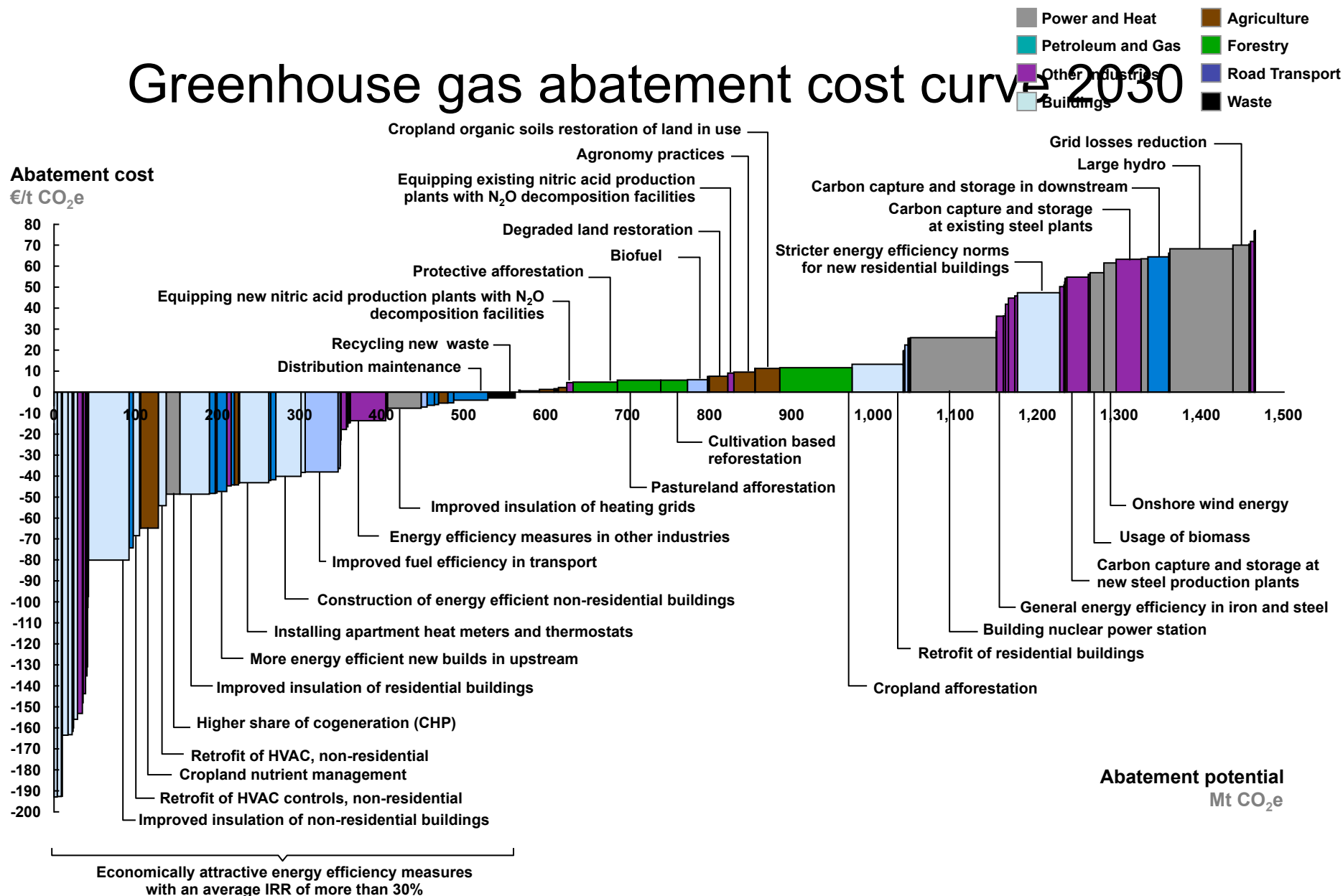
- McKinsey
Russian
Report:
- CO₂
abatement
through EE

Russia's baseline greenhouse gas emissions and the abatement potential in 2030

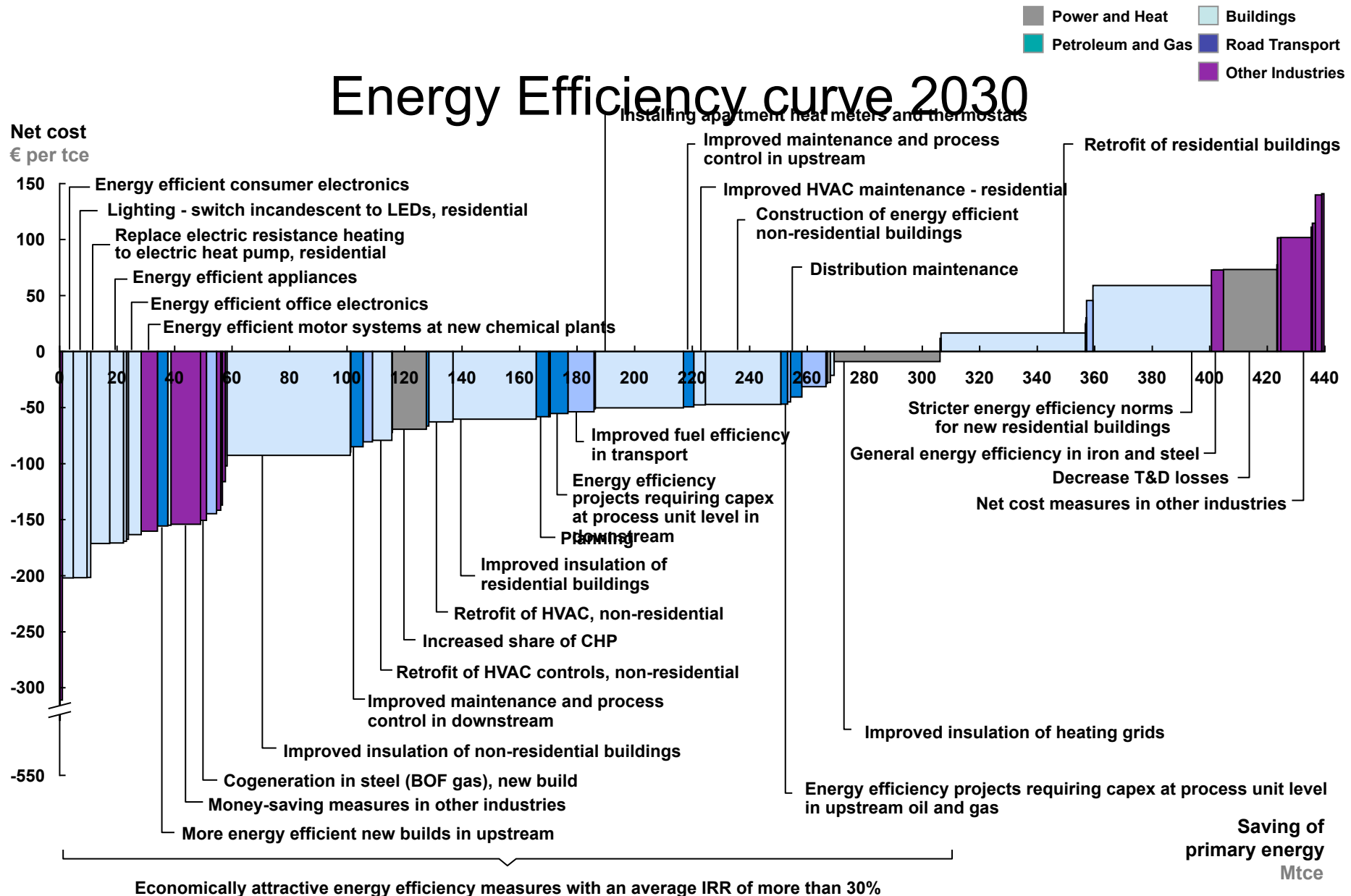
■ Money-saving measures



Greenhouse gas abatement cost curve 2030

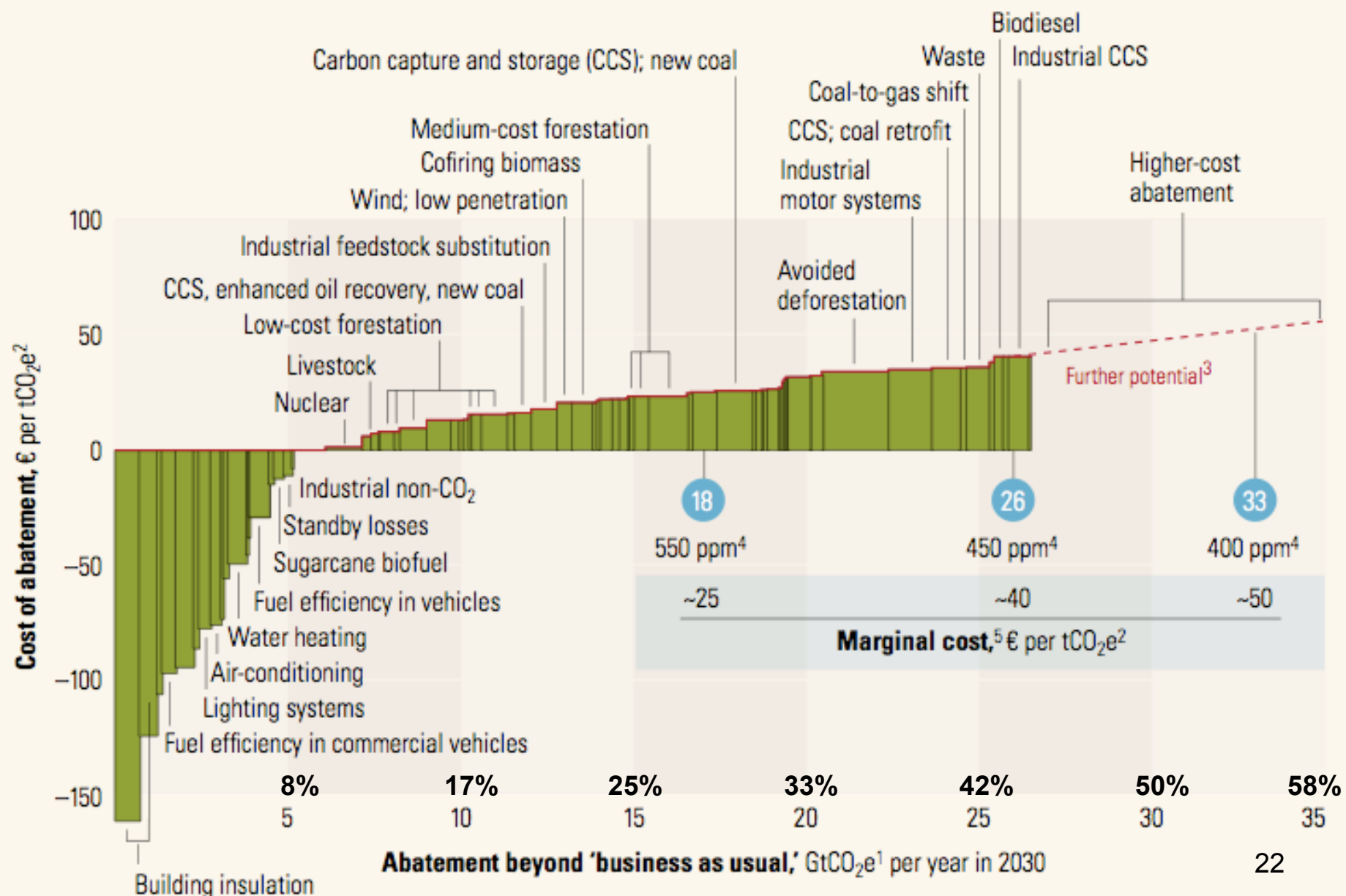


Energy Efficiency curve 2030



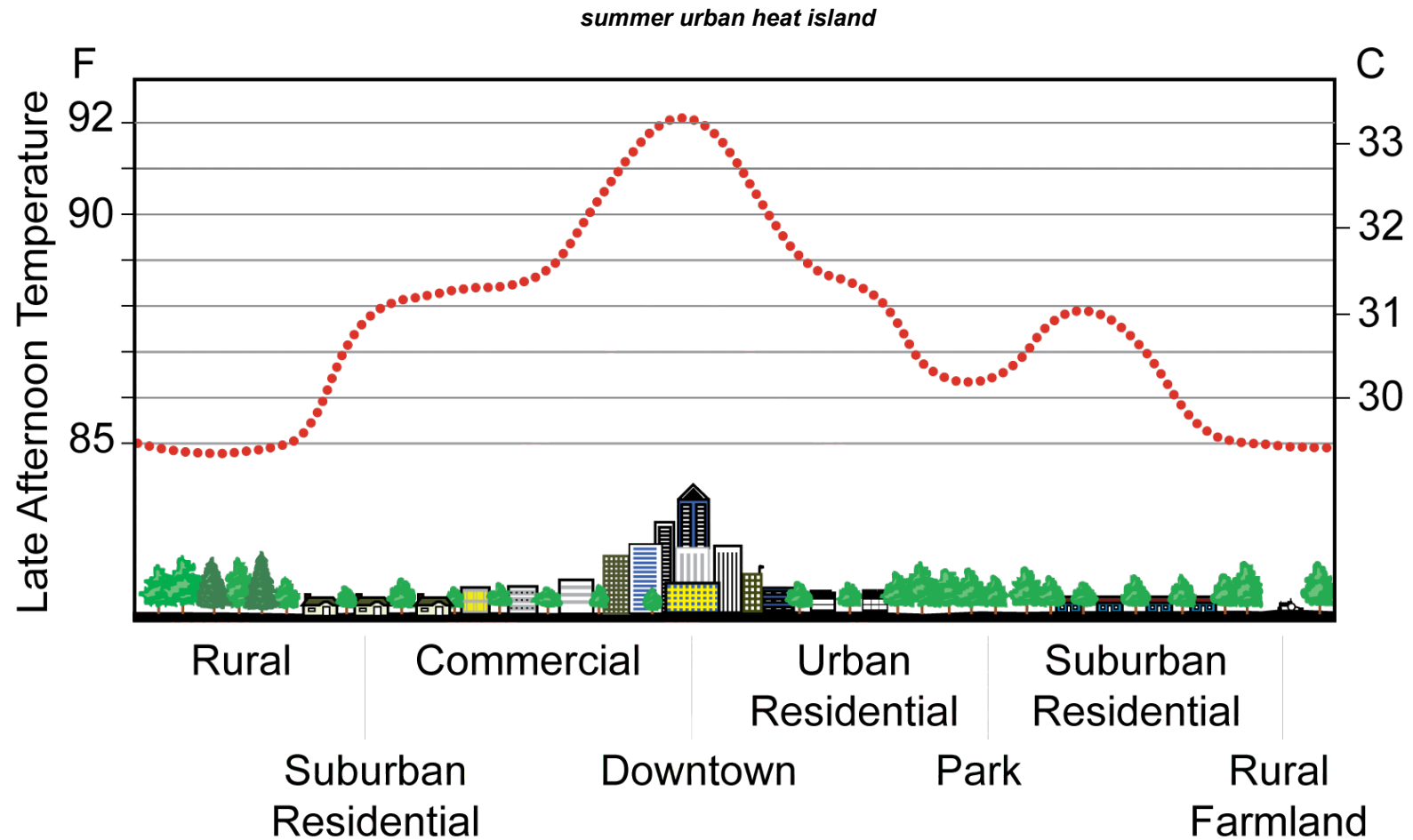
Global cost curve for greenhouse gas abatement measures beyond 'business as usual'; greenhouse gases measured in GtCO₂e¹

- Approximate abatement required beyond 'business as usual,' 2030



White roofs to cool your
buildings, your cities, and
(this is new) to cool the earth.

Summer in the city

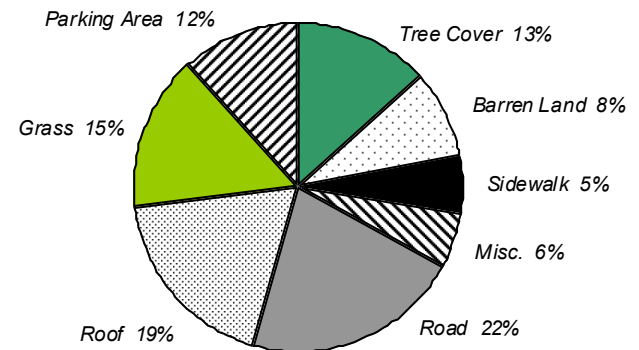


Bird's eye view of urban land use



The surface of Sacramento, CA is about

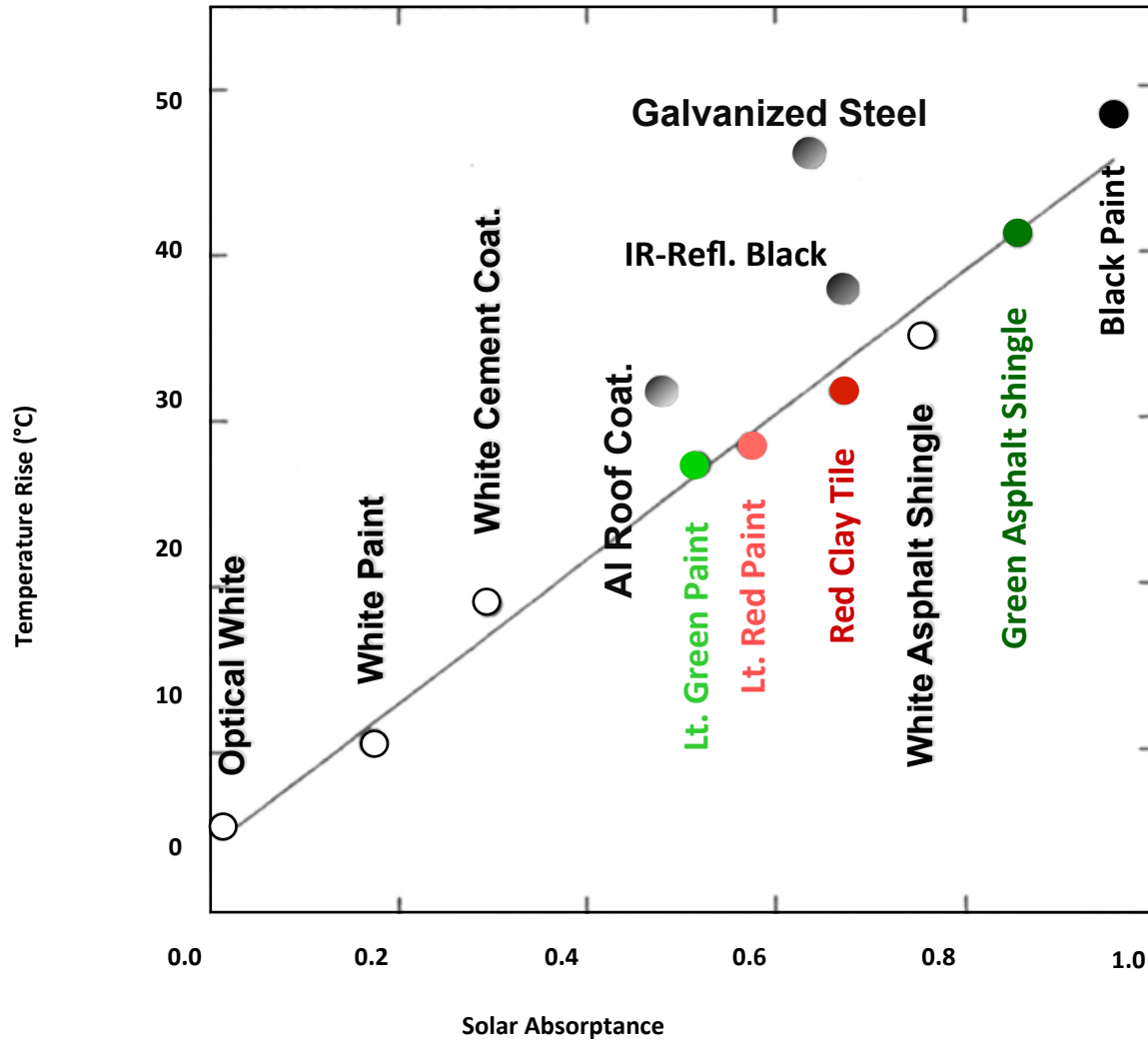
- **20% roofs**
- **30% vegetation**
- **40% pavement**



Area by Land-Cover Category Above the Canopy

~ 1 km²

Reflective roofs stay cooler in the sun



White roofs, cool-colored roofs save money

OLD



flat, white



pitched, white

NEW



pitched, cool & colored

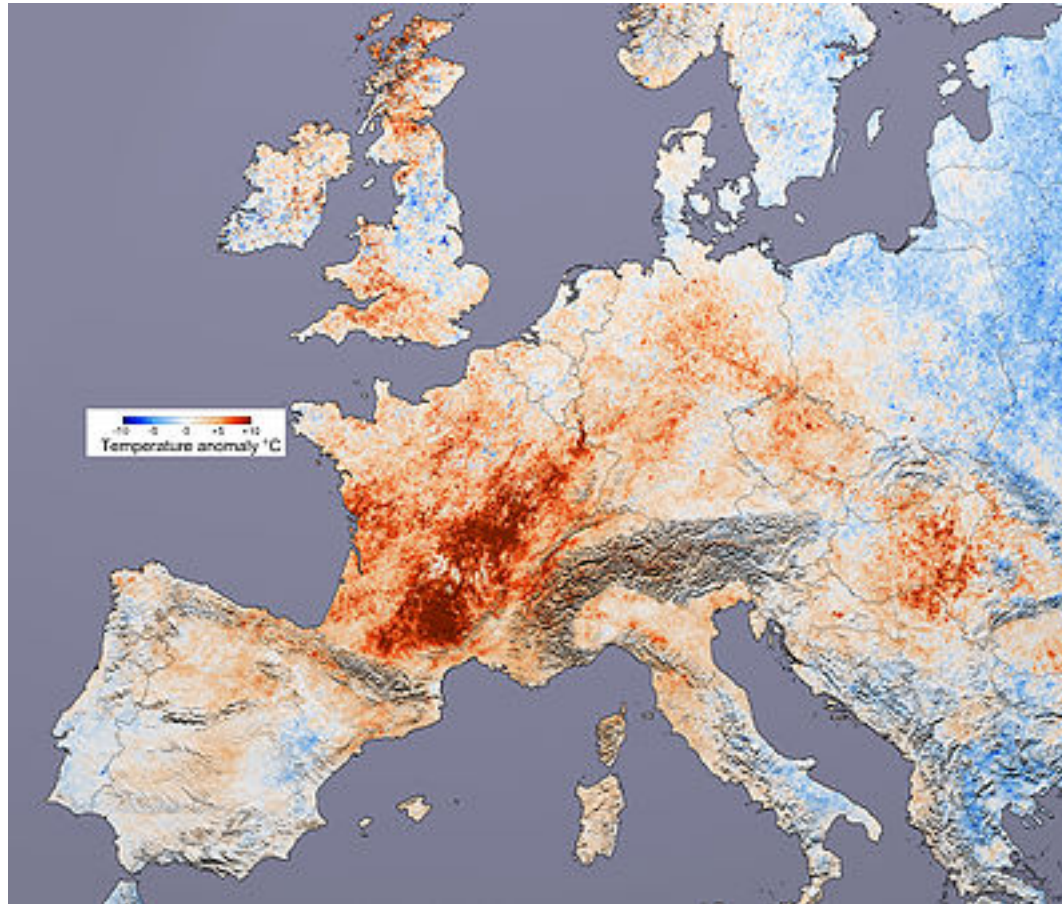
Chicago Heat Wave 1995, 739 Deaths

The most lethal floor was the top floor of a building
with a black roof



European Heat Wave 2003, 30,000 Deaths

Moscow-Centered Heat Wave 2010, ~10,000 Deaths



White roofs around the world

...in Santorini, Greece



...in Hyderabad, India

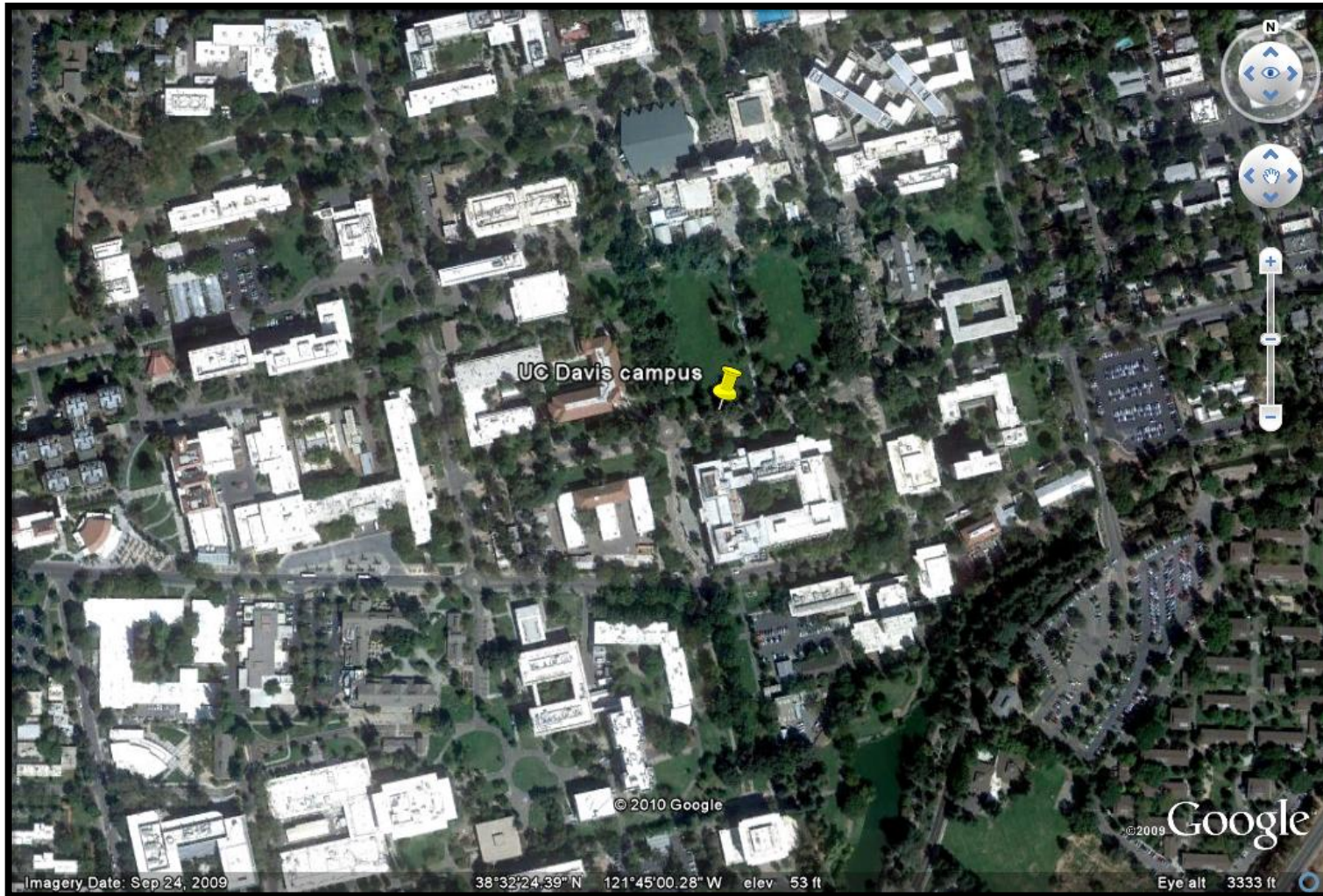


**...and widely
in the state of
Gujarat, India.**

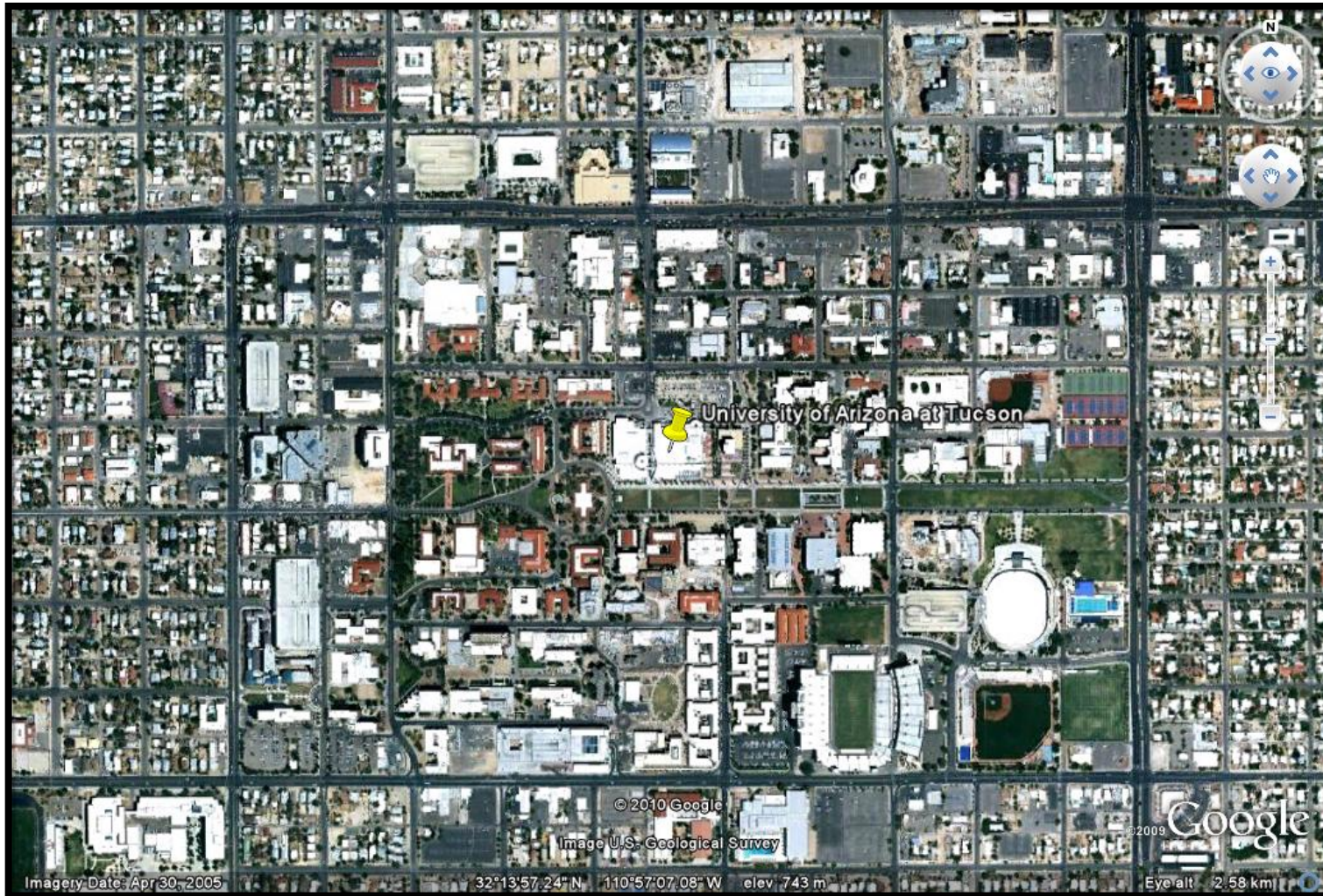
Walmart store in northern California



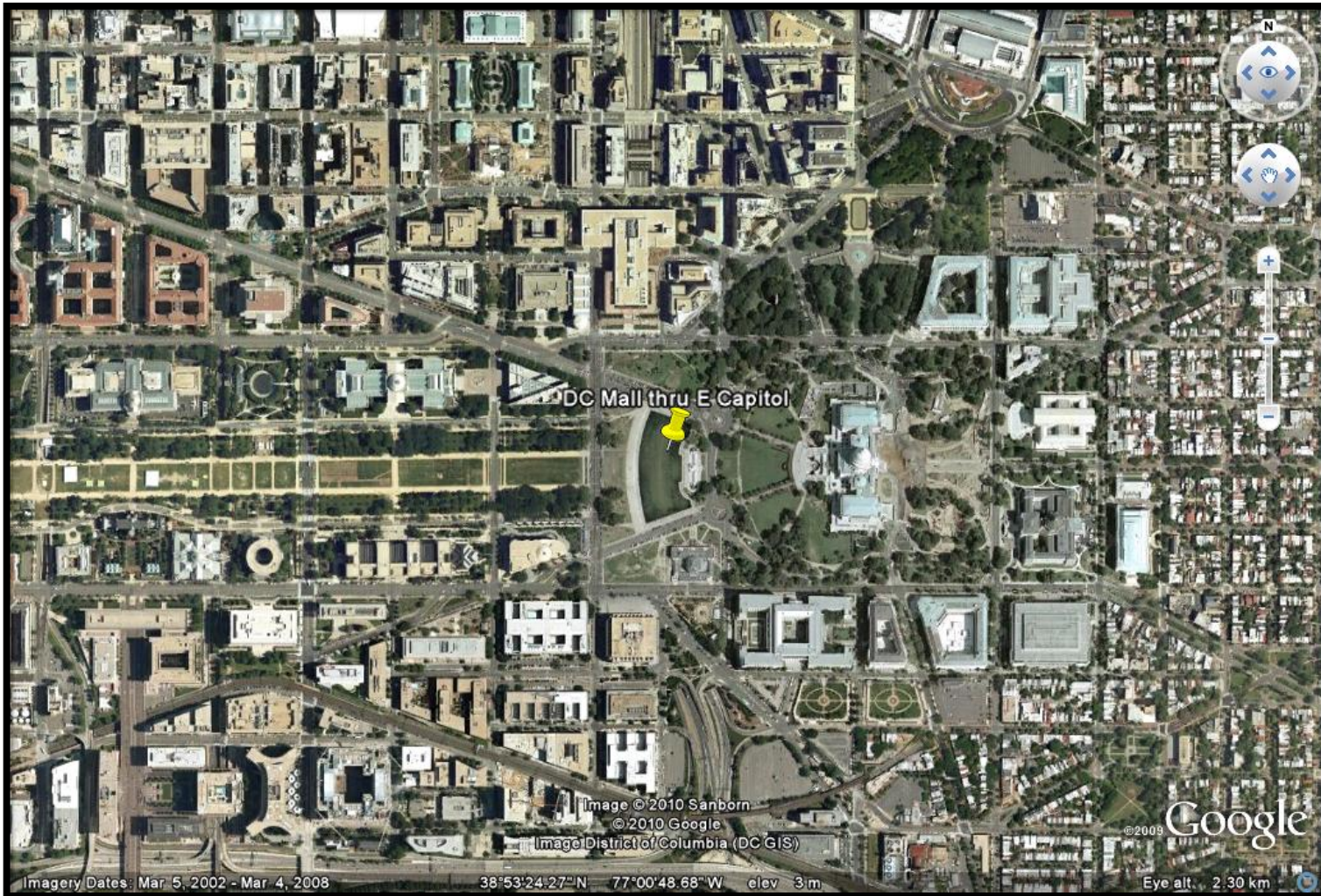
Congratulations to UC Davis



White roofs are popular in Tucson, AZ



Washington, DC (Federal) has problems



Pentagon

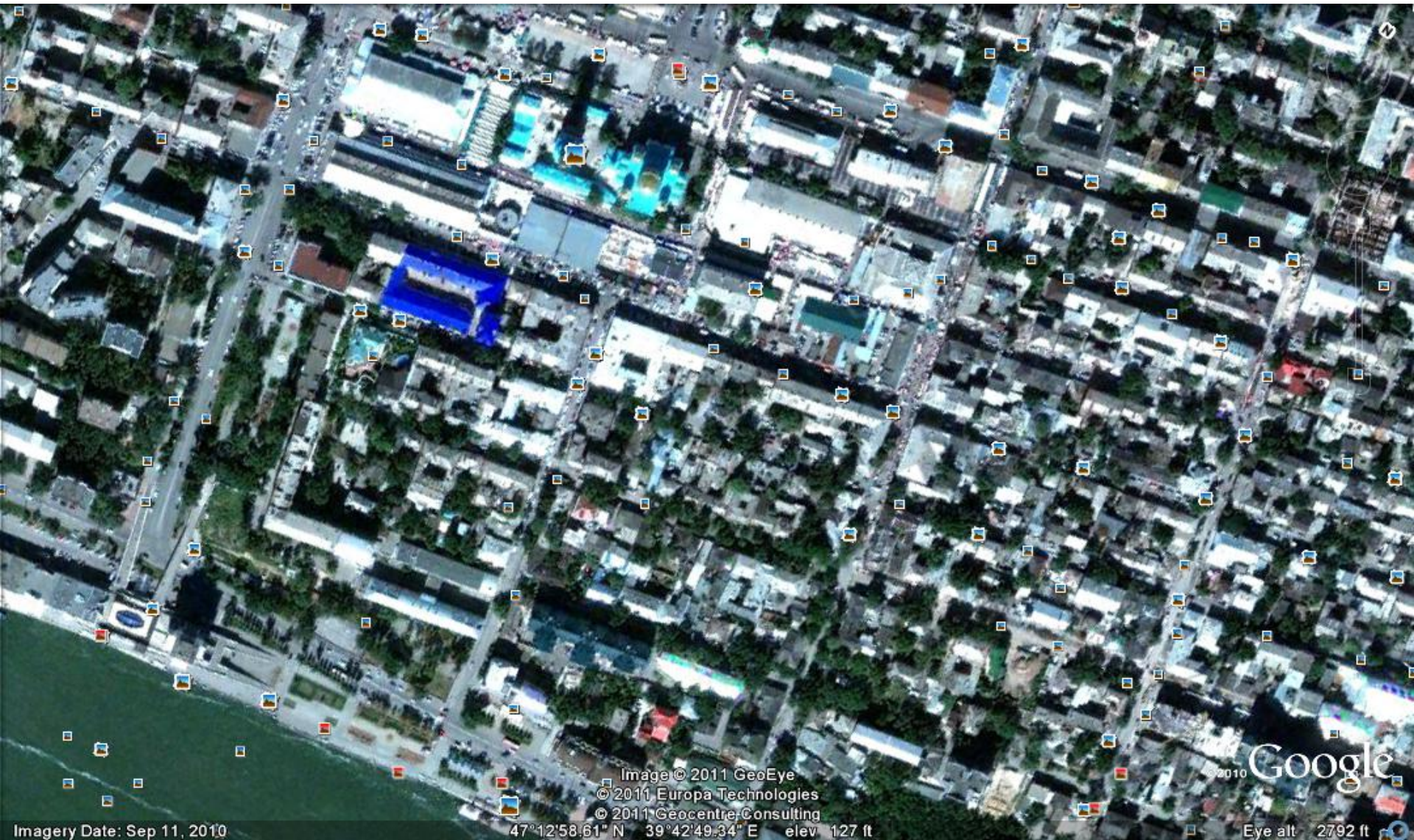


Imagery Dates: Feb 1, 2006 - Mar 4, 2008

38°52'14.52"N 77°03'21.67"W elev 0 m

Eye alt 502 m

Rostov on Don, white roofs

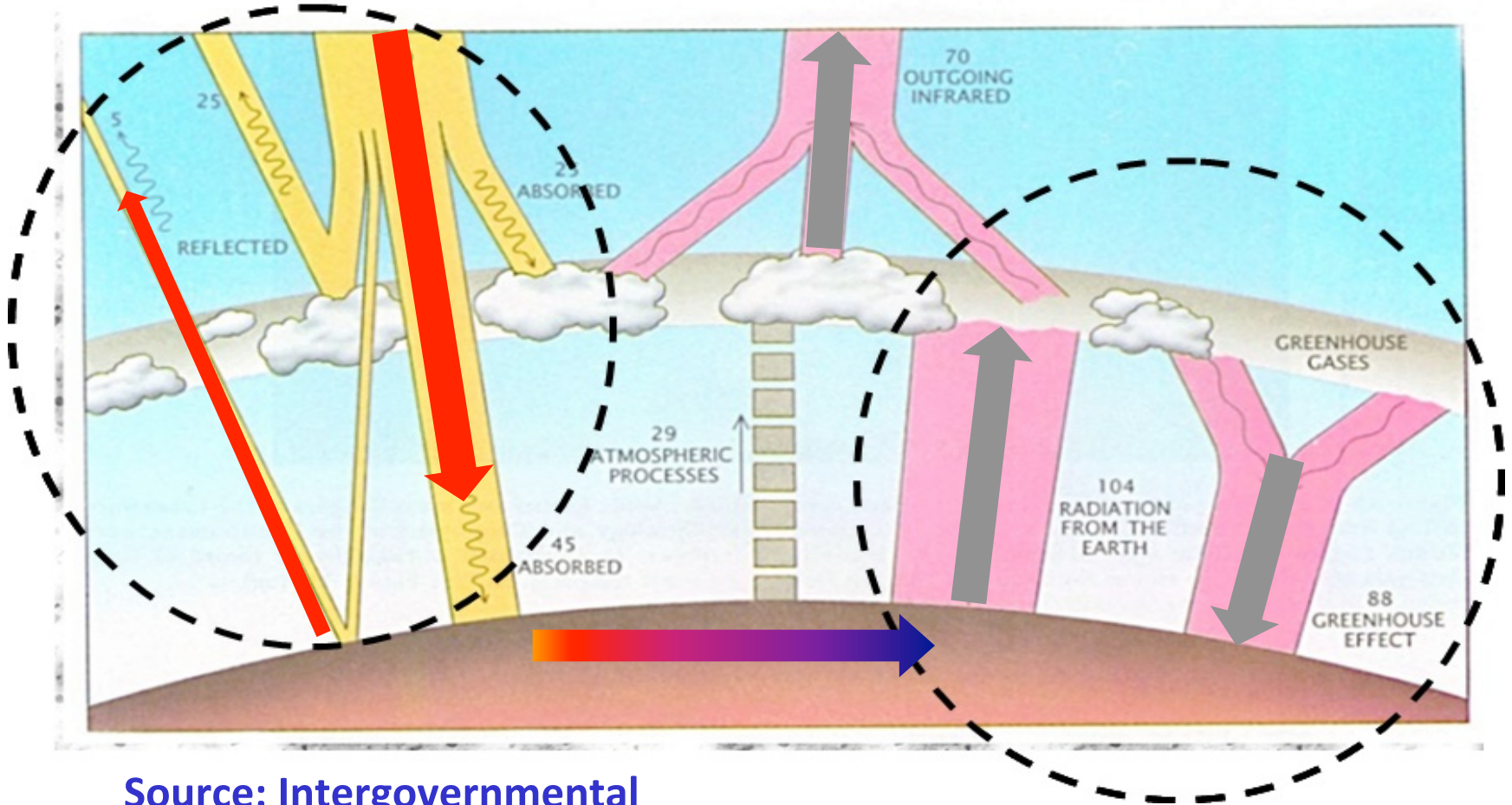


Baku, dark roofs



Cooling our planet

Solar-reflective surfaces cool the globe via “negative radiative forcing”



Source: Intergovernmental
Panel on Climate Change (IPCC)

GLOBAL COOLING: making 100 m² (1000 ft²) of gray roofing white offsets the **emission** of 10 t of CO₂



How much CO₂ equivalent is offset if we whiten all eligible urban flat roofs worldwide? (i/ii)

- Answer: **24 Gigatonnes (Gt)**
 - 2/3 of a year's worldwide emission
 - Gigatonne = billion metric tons
- If implemented over 20 years (the life of a roof or a program) this is ≈ 1.2 Gt/year.

How much CO₂ equivalent is offset if we whiten all eligible urban flat roofs world-wide? (ii/ii)

- Offset is equivalent to **taking 300 million cars off the road for 20 years.**
 - There are about 600 million passenger cars world wide, and they each emit $\approx 4 \text{ t CO}_2/\text{year}$.



In terms of avoided power plants

Full white roof potential can *offset* the emissions from 500 medium-sized coal fired power plants or 1,000 medium-sized gas fired power plants.

That is just the albedo effect – if the building is air conditioned, it will avoid comparable *real* CO2 back at the power plant.



LAWRENCE BERKELEY NATIONAL LABORATORY PRESENTS:
SCIENCE AT THE THEATER

COOL CITIES, COOL PLANET

What to do now

Progress in energy efficiency standards

- In 2005, California's "Title 24" energy efficiency standards prescribed white surfaces for low-sloped roofs on commercial buildings. Several hot states are following.
- In 2008, California prescribed "cool colored" surfaces for steep residential roofs in its 5 hottest climate zones.
- **Other U.S. states & all countries with hot summers should follow.**

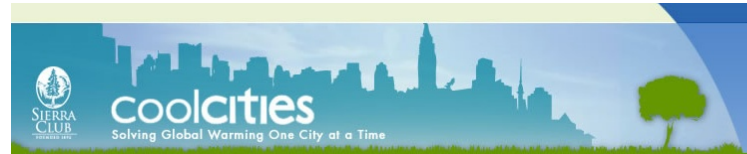
Recent cool roof progress (2005 – 2011)

- 2005
 - California Title 24 – “Flat roofs shall be white” (15 out of 16 climate zones). Walmart adopts white roofs for ALL stores.
 - EPA ENERGY STAR lists Cool Roof Materials
- 2010
 - June 1st, 2010 – Memo from U.S. Energy Secretary Steven Chu calls for all DOE Buildings to have white roofs, if cost-effective
 - June 16th, 2010 – Marine Corp follows suit, Pentagon following slowly
 - June 19th, 2010 – *RetroFIT Philly* announces winner of “coolest block” contest to white-coat black roofs of row houses.
- 2011
 - 100 Cool Cities launched – see www.WhiteRoofsAlliance.org
 - Spring 2011 – US will launch, at G20 Energy Ministers meeting, a voluntary Cool Roofs initiative and may even offer technical assistance to developing countries who join early.

To come 2012...

- Model codes will be modified to prescribe “flat roofs shall be white”
 - ASHRAE for commercial buildings
 - EECC for residential buildings
- But states and cities have to **adopt** model codes

Global Cool Cities Alliance could unite many initiatives and trade associations



EMERALD CITIES COLLABORATIVE
GREEN • FAIR • DEMOCRATIC



American Council for an Energy-Efficient Economy

THE CLIMATE GROUP

Resources on the web

- **Art Rosenfeld's website**
 - ArtRosenfeld.org
- **Cool Colors Project**
 - CoolColors.LBL.gov
- **Heat Island Group**
 - HeatIsland.LBL.gov
- **Cool Communities Project**
 - CoolCommunities.LBL.gov
- **Roof Savings Calculator**
 - RoofCalc.com
- **Global Cool Cities Alliance**
 - GlobalCoolCitiesAlliance.org
- **Cool Roof Rating Council**
 - CoolRoofs.org
- **Cool California**
 - CoolCalifornia.org
- **EPA Heat Islands**
 - epa.gov/heatisland
- **Energy Star Cool Roofs**
 - EnergyStar.gov